

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:	)	
Hidetoshi ISHIDA et al.	)	Group Art Unit: 2891
Application No. 09/707,844	)	Examiner: Dana Farahani
Filed: November 8, 2000	)	Confirmation No. 9493
For: RADIO FREQUENCY SIGNAL	)	Date: June 14, 2007
PROCESSING	)	

**REQUEST FOR RECONSIDERATION**

**Mail Stop Amendment**  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

Sir:

In reply to the March 15, 2007, Office Action, Applicants respectfully request reconsideration and withdrawal of the rejection of the claims. Claims 11-21 currently are pending.

In the most recent Office Action, claims 11-14, 17 and 18 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Inoue (U.S. Patent No. 5,151,770 – hereafter Inoue). Further, claims 15, 16 and 19-21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Inoue as applied to claims 11-14 above, and further in view of Nakamura et al. (U.S. Patent No. 6,229,209 – hereafter Nakamura). These rejections are respectfully traversed at least for the reasons provided below.

As set forth in MPEP §2142, the Examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness. To establish a *prima facie* case of obviousness, three criteria must be met. First, there must be some suggestion or motivation, to modify the references or to combine reference teachings. Second, there must be reasonable expectation of success. Finally, the prior art must teach all of the claim limitations.

Applicants respectfully point to the final prong of the test, which states the prior art must teach all of the claim limitations. At the very least, the combination of cited references

do not teach all of the claim limitations of independent claims 1 and 15 for the reasons set forth below.

Initially, it is unclear to the Applicants how Inoue alone teaches the features of claim 18 which depends on independent claim 15. Perhaps the Examiner intended to group claim 18 with the combination of Inoue and Nakamura mentioned above.

Independent claim 11 recites, among other things, the features of “a plurality of through holes which are provided between two adjacent ones of the plurality of semiconductor elements and pass from a surface through the backside of the semiconductor substrate, wherein a distance between two adjacent holes of the plurality of through holes is smaller than a thickness of the semiconductor substrate so as to reduce power leaking between two adjacent ones of the plurality of semiconductor elements.” That is, a particular feature of the RF device recited in independent claim 11 resides not only in the fact that the distance between the two adjacent through holes is smaller than the thickness of the semiconductor substrate so as to reduce power leakage between two adjacent semiconductor elements, but also that the device includes a plurality of semiconductor elements formed on a semiconductor substrate composed of a semiconductor material. In accordance with Applicants’ claimed invention and as set forth on page 8, lines 13-18 of Applicants’ specification as well as Fig. 2, such a feature improves the isolation between the two semiconductor elements devices having through holes therebetween with respect to the radio frequency signal.

Inoue discloses setting the distance between two adjacent through holes to 100  $\mu\text{m}$  and using GaAs as a substrate, and further discloses that the sum of a thickness of the substrate and a thickness of an insulating layer is larger than the distance between the through holes. However, the thickness of the substrate taught in Inoue includes a thickness of the insulating layer formed on the substrate, *i.e.*, 500  $\mu\text{m}$  plus a thickness of the substrate 21. Therefore, the thickness in Inoue is not a thickness of the substrate 21 alone. Since Inoue does not disclose or suggest a thickness of the substrate 21, the structural relationship between the through holes and the thickness of the substrate is not known by the teachings of Inoue directly or indirectly.

Furthermore, a principal objective of Inoue is to form its through holes in the insulating layer. In general, it is well known that insulating layers have a smaller dielectric constant than semiconductor substrates; therefore, RF signals propagate more to the

semiconductor substrate than to the insulating layer taught in Inoue. It should be noted that generally electromagnetic waves tend to pass through the areas where the dielectric constant is high. Now even if the through holes are formed in the insulating layer at a short distance between themselves, the structural relationship between the distance between the through holes and the thickness of the substrate is not taught by Inoue given that Inoue fails to disclose a thickness of the substrate alone. Thus, it cannot be said that the structure of Inoue “further insulates the integrated circuits of the substrate from RF interfering,” as asserted by the Examiner.

The Examiner further asserts that Inoue discloses the features of “through holes having spacing substantially less than a wavelength of the operating frequency of the circuits in the layer which the through holes are located” and that “it would have be obvious to one of ordinary skill in the art at the time of the invention to make the distance between the through holes smaller than the thickness of the substrate ...” (last paragraph on page 2 of the Office Action). However, Applicants contend that if the frequency of the circuits is set to 1 to 60 GHz, which is a range often adopted by those skilled in the art, the operating frequency of the circuits will become 5 to 300 mm, which is much greater than 500  $\mu\text{m}$ , the disclosed thickness of the insulation layer in Inoue. In other words, it would be obvious to those skilled in the art that the operating frequency of the circuits is greater than the thickness of the substrate without having to rely upon any teachings of Inoue.

In contrast, the present invention does not look to the operating frequency of the circuits being greater than the thickness of the substrate, but rather looks to the structural relationship between the substrate thickness and the distance between two adjacent through holes, *i.e.*, making the distance between the adjacent through holes smaller than the substrate thickness, when improving isolation between two adjacent semiconductor elements. This feature is not taught or suggested by the disclosed features or structure of Inoue. Thus, it cannot be said that Inoue makes the present invention obvious.

Independent claim 15 recites, among other things, the features of “a first group of through holes which are provided between two adjacent ones of the plurality of semiconductor elements and pass from a surface through the backside of the semiconductor substrate and whose side faces are covered with a conductive material; and a second group of through holes which are provided in electrodes of the plurality of semiconductor elements, pass from a surface through the backside of the semiconductor substrate, and whose side

faces are covered with the conductive material, wherein the conductive material which covers side faces of the first and second groups of through holes is electrically connected to a first wiring layer provided on the backside of the semiconductor substrate, and a distance between two adjacent ones of the first group of through holes is smaller than a thickness of the semiconductor substrate so as to reduce power leaking between two adjacent ones of the plurality of semiconductor elements.” In other words, through holes for shielding and through holes for electrodes of a semiconductor device are simultaneously formed (see page 10, lines 14-17 of the present specification) and making a distance between two adjacent through holes smaller than a thickness of the semiconductor substrate so as to reduce power leaking between two adjacent semiconductor elements are disclosed. These features and structure greatly improves isolation of the two semiconductor elements, having through holes therebetween with respect to radio frequency (RF) signals, as shown in FIG. 2 of the present application.

Nakamura merely discloses that side faces of the through holes are covered with a metal film or layer, but fails to disclose the features of making the distance between two adjacent through holes small so as to improve isolation between two adjacent semiconductor elements.

Further, neither Inoue nor Nakamura disclose through holes for shielding and through holes for electrodes of a semiconductor device, as claimed. Consequently, it cannot be said that Inoue and Nakamura, taken alone or in combination, teach or suggest the features of simultaneously forming a first group of through holes and a second group of through holes, as presently claimed.

Further, claims 20 and 21 recite, among other things, the feature of downsizing an RF device by connecting elements of the RF device to a wiring layer. Neither Inoue nor Nakamura disclose this feature. Thus, it cannot be said that Inoue and Nakamura, taken alone or in combination, teach or suggest the feature of downsizing an RF device by connecting elements of the RF device to a wiring layer, as presently claimed.

Therefore, in view of the foregoing it is respectfully requested that the rejections of record be reconsidered and withdrawn by the Examiner, that claims 11-21 be allowed and that the application be passed to issue.

Based on the foregoing, Applicants respectfully submit the Section 103 rejections fail to establish a *prima facie* case of obviousness with respect to all pending claims 11-21. As such, the rejection should be withdrawn and the application allowed without further delay.

Respectfully submitted,

/Sean A. Pryor, Reg. # 48103/  
Sean A. Pryor

NIXON PEABODY LLP  
CUSTOMER NO.: 22204  
Suite 900, 401 9<sup>th</sup> Street, N.W.  
Washington, D.C. 20004-2128  
(202) 585-8000